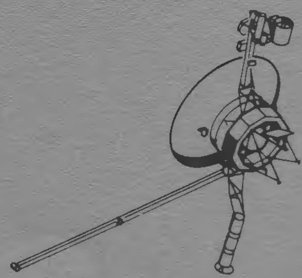
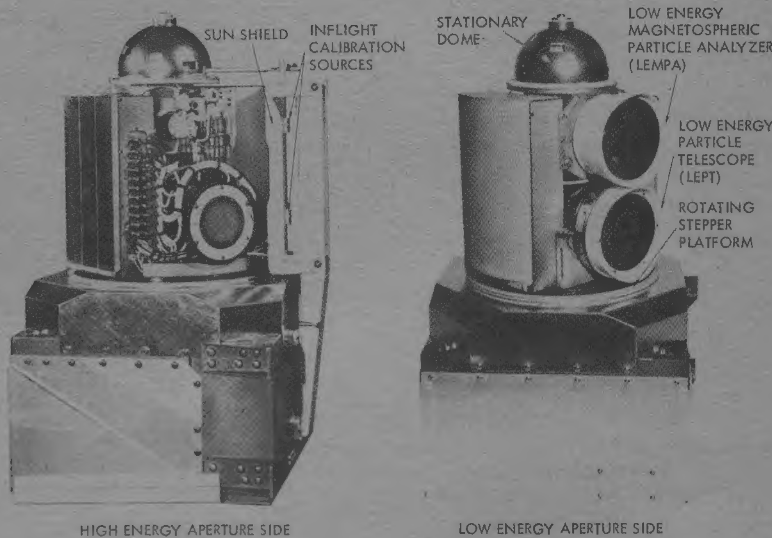


MISSION STATUS BULLETIN

VOYAGER

October 25, 1978 **No. 25**



Low-Energy Charged Particle Instrument. The LECP, located on the science boom about midway between the spacecraft bus and the scan platform, uses two detector systems to measure both planetary systems and interplanetary space.

Summary

Voyager 1 is about 675 million kilometers (420 million miles) from Earth, travelling with a heliocentric velocity of 14.9 kilometers (9.3 miles) per second. One-way light time is 37 minutes 36 seconds. Encounter operations begin in 78 days. Encounter test and training begins October 30.

One-way light time to Voyager 2 is 35 minutes 27 seconds. The craft is nearly 637 million kilometers (396 million miles) from Earth, with a heliocentric velocity of 13.6 kilometers (8.5 miles) per second. Encounter operations are six months away.

Update

Voyager 1

Capability Demonstration Test No. 2

The second of Voyager 1's three capability demonstrations was successfully performed on October 9 and 10. Consisting of two parts, the test included execution of the early portion of the near encounter sequence and a test of the flight data subsystem's ultraviolet spectrometer autogain algorithm.

Part 1 included a test of a six-hour period just after Jupiter closest approach, when the spacecraft will pass through both the Io flux tube and Jupiter's shadow on the far side of the planet. During this period, measurements of Jupiter's atmosphere will be made as the Earth and Sun disappear behind the edge of the planet.

In Part 2, the ultraviolet spectrometer was first slewed so that the viewing slit was within 19.5 degrees of the Sun, and then swept to 19.0 degrees. The purpose of the one-hour test was to measure the response of the instrument to changing light levels while under automatic control of the flight data subsystem.

Voyager 2

IRIS Performance Improves

After a 20-hour warm-up initiated on September 28, the performance of the infrared interferometer spectrometer (IRIS) has greatly improved. The data indicate a full recovery of performance in the neon signal of the reference interferometer, and a substantial increase in the sensitivity of the infrared interferometer spectrometer to long wavelengths.

Using the flash-off heater, the instrument temperature was raised from 200° Kelvin (the normal operating point) to 267° Kelvin in an effort to reverse any crystallization of the motor damper and beamsplitter bonding material that was thought to be responsible for the slow degradation observed since launch.

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Voyager 2's IRIS will be monitored to determine if future heating will be required to maintain the improved performance.

A similar warm-up of the Voyager 1 IRIS began October 24 in an attempt to eliminate anomalies first noted in July 1978.

The Voyager Spacecraft

(This is the seventh in a planned series of brief explanatory notes on the spacecraft and its subsystems.)

Part 7 — Low-Energy Charged Particles Investigation

While Voyager 1's current speed of about 54,000 kilometers (33,000 miles) per hour far exceeds the space speed record for man*, an ion travelling at that velocity would hardly qualify as a significant energetic particle to the low-energy charged particle (LECP) experiment.

To the LECP, low-energy means particles travelling at 2400 to 28,000 kilometers (1500 to 18,000 miles) per *second*, as opposed to high-energy particles travelling at the speed of light, 300,000 kilometers (186,000 miles) per second.

The LECP investigation is a strong coupling factor in Voyager's complement of fields and particles investigations, contributing to many areas of interest, including studies of solar wind, solar flares, particle accelerations, magnetic fields, cosmic rays, and satellite surface structures.

Scientific Objectives

Two detector systems of the LECP instrument will allow measurements during both the long interplanetary cruise periods and the encounters with the planetary systems themselves. The extremely wide dynamic range, combined with wide coverage in energy and species, will allow characterization of almost all energetic particle environments Voyager traverses.

Study of the physics of planetary magnetospheres will further understanding of astrophysical objects such as pulsars and compact X-ray sources, the origin of satellites and their surface structures, and perhaps, the origin of the solar system itself.

An important task of the LECP will be to establish the morphology of the Saturnian and Uranian magnetospheres, including bow shock, magnetosheath, magnetotail, trapped radiation, and satellite-energetic particle interactions.

Observations of particle accelerations will aid in better understanding of solar flare processes, cosmic ray acceleration processes, and processes in our own magnetosphere.

Next to the Sun, Jupiter is the solar system's single most powerful radio source in the electromagnetic spectrum. The reasons for this are not well understood, but may stem from an apparent strong interaction between Jupiter's magnetosphere and the Galilean satellite Io. The Io-Jupiter interaction could be of importance in understanding other astrophysical radio sources.

*39,897 kilometers (24,791 miles) per hour, set by American astronauts Stafford, Cernan, and Young in Apollo X on May 26, 1969, at an altitude slightly less than 122 kilometers or 76 miles.

Fusion research may also benefit from Voyager's probing of the trapped radiation around Jupiter. Particles in confined plasmas, forced to fuse, release an enormous energy. Clearly, Jupiter is able to confine charged particles very nicely.

Instrument Description

Located on the science boom, the LECP consists of two solid-state detector systems mounted on a rotating platform to give full-sky coverage.

The Low-Energy Magnetospheric Particle Analyzer (LEMPA) will be used primarily for magnetospheric observations near the target planets. Eight solid-state silicon sensors measure the energy and count the number of particles colliding with their surfaces. The LEMPA measures electrons in the range from about 10 kilo electron volts (keV) to 11 mega electron volts (MeV), and protons and heavier ions in the 15 keV to 150 MeV range. The dynamic range is about 1 to more than 10^{11} (nearly one trillion) particles per square centimeter per second from the entire celestial sphere, extending to 10^{13} for some of the sensors.

The Low Energy Particle Telescope (LEPT) contains fifteen solid-state detectors designed to measure the charge and energy distributions of low and medium energy nuclei in the interplanetary medium and the outer regions of planetary megnetospheres. The LEPT uses two of the thinnest detectors ever flown: 2 and 5 microns (1 inch is about 25,400 microns)! Its range is from about 0.1 to 40 MeV per nucleon, but certain modes may extend the range from 0.05 to 500 MeV per nucleon.

Both detector systems are mounted on a rotating platform which can step through a full 360° circle which is divided into eight angular sectors. Stepping rates range from 1 revolution every 48 minutes during cruise to 1 revolution every 48 seconds during encounter operations. A fixed sunshield protects the most sensitive detectors from viewing the Sun early in the mission, and serves as a high energy particle shield during traversal of the magnetosphere.

Detailed design of the LEMPA telescope and LEPT anti-coincidence detectors were done at the University of Maryland, with assembly at the Applied Physics Lab at Johns Hopkins University. The LEPT telescope was designed and built at the Applied Physics Lab.

In-Flight Performance

The LECP has performed according to specifications so far, and has obtained very good data on solar flare and interplanetary particles, and Jovian electrons.

Investigators

The LECP principal investigator is S. M. Krimigis of the Applied Physics Lab (APL) at Johns Hopkins University. Co-investigators are T. P. Armstrong (University of Kansas), W. I. Axford (Max Planck Institute for Aeronomy, West Germany), C. O. Bostrom (APL), C. Y. Fan (University of Arizona-Tucson), G. Gloeckler (University of Maryland), and L. J. Lanzerotti (Bell Telephone Laboratories, Murray Hill, New Jersey).